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WITNESS my hand this
Third day of December 2004

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Britax Childcare Pty Ltd

AUSTRALIA

PATENTS ACT 1990

PROVISIONAL SPECIFICATION FOR THE INVENTION ENTITLED:

"SEAT BELT RETRACTION MECHANISM"

This invention is described in the following statement:

FIELD OF THE INVENTION

The present invention relates to a belt retraction mechanism. In one particular form, the present invention relates to a seat belt retraction mechanism for a child restraint seat.

BACKGROUND OF THE INVENTION

Current seat belt retraction mechanisms typically involve a combination of a spring loaded spool in combination with an associated ratchet and pawl arrangement. The pawl is spring loaded to engage a tooth of the ratchet thereby preventing rotation of the spool. However, the standard ratchet and pawl arrangement has a significant disadvantage. This is best illustrated by considering Fig. 1 which shows a seat belt retractor having a spool biased to retract the belt in an anti-clockwise direction (direction of curved arrow). The teeth of the ratchet have a first generally front vertical face and a rear sloped face. In the event of the belt being pulled from the retractor (direction of straight arrow), the pawl abuts against the vertical face thus locking the belt against any movement from the retractor.

In operation, the pawl is first released from the ratchet by an actuator thus allowing the spool to rotate and the belt to be removed under tension from the spool. Following fitting of the belt over the child, often in combination with other separate belt and/or buckle portions, the belt retracts under tension and the pawl is allowed to re-engage with the ratchet and thus the child is suitably restrained. However, the pawl will often engage with the intermediate rear sloped surface of a tooth between two adjacent vertical faces. Thus when pulling the belt from the retractor, the spool will move clockwise until the pawl positively engages and abuts against the next vertical face. This implies that there is a certain amount of belt that will travel out from the retractor before the pawl and ratchet mechanism locks the belt.

As a sudden clockwise direction of the spool would be symptomatic of an accident, where the momentum of the child would act to remove the belt from the retractor, the extra amount of the travel in the belt will loosen the restraint resulting in a potentially dangerous and unsafe situation.

It is an object of the present invention to provide a belt retraction mechanism which enables improved belt locking.

SUMMARY OF THE INVENTION

In a first aspect the present invention accordingly provides a belt retraction mechanism including:

a biased spool having said belt wound thereon, said spool biased to retract said belt;

a biased cam member having an engagement surface, said cam member resiliently moveable from an engagement position wherein said engagement surface engages said belt thereby preventing movement of said belt to an open position; and

an actuator,

wherein said actuator is manually operable to an open setting to cause said cam member to move from said engagement position to said open position.

As the engagement surface of the cam member performs the function of releasing and locking the belt, the disadvantages of the prior art pawl and ratchet mechanisms outlined herein are substantially overcome.

Preferably, on release of said actuator from said open setting, said cam member moves from said open position to said engagement position. This is an added safety measure as the cam member will naturally travel back to the engagement position on release of the actuator.

Preferably, said cam member is pivotable and includes a cam arm abutting said actuator and located at an opposite end to said engagement surface, wherein on movement of said actuator to said open setting said cam member is caused to rotate from an engagement position to an open position. By having the cam arm directly contacting the actuator, movement of the actuator can be used in a simple and effective manner to change the position of the cam member.

Preferably, said actuator is retained in substantially linear slots to guide movement of said actuator when acting against said cam arm. This arrangement simplifies manufacturing substantially.

Further, preferably said actuator further includes a handle, said handle arranged to be operable from a location substantially opposite to an inlet of said belt retraction mechanism into which said belt is retracted. By positioning the handle opposite to the inlet one hand may be used to pull the belt from the belt retraction mechanism whilst the other hand operates the handle in a convenient and ergonomic position.

Preferably, said engagement surface engages said belt by gripping said belt between said engagement surface and a surface of said inlet.

In a second aspect the present invention accordingly provides a belt retraction mechanism including:

a biased spool having said belt wound thereon, said spool biased to retract said belt;

a pawl and ratchet mechanism for preventing rotation of said spool in a direction of retraction;

a biased cam member having an engagement surface, said cam member resiliently moveable from an engagement position wherein said engagement surface engages said belt thereby preventing movement of said belt to an open position; and

an actuator;

wherein said actuator is manually operable to an open setting to release said pawl and ratchet mechanism and furthermore cause said cam member to move from said engagement position to said open position, thereby allowing said belt to be moveable.

As the cam member locks the belt, the pawl and ratchet mechanism can be arranged to prevent further rotation of the spool thereby reducing tension on the belt between the engagement surface and the spool. This also substantially addresses the disadvantages of prior art pawl and ratchet mechanism described herein as pawl and

ratchet mechanism does not have the primary function of locking the position of the belt.

Preferably, on release of said actuator from said open setting said pawl and ratchet mechanism reengages thereby preventing rotation of said spool.

Further preferably, on release of said actuator from said open setting, said cam member moves from said open position to said engagement position.

Further preferably, a pawl of said pawl and ratchet mechanism is integral to said actuator.

BRIEF DESCRIPTION OF THE DRAWINGS

An illustrative embodiment of the present invention will be discussed with reference to the accompanying drawings wherein:

Fig. 1 is a side view of a prior art pawl and ratchet mechanism;

Fig. 2 is a first upper side perspective view of a belt retraction mechanism without the housing cover according to a preferred embodiment of the present invention;

Fig. 3 is a second upper side perspective view of the belt retraction mechanism illustrated in Fig. 2;

Fig. 4 is a sectional side view of the belt retraction mechanism including the housing cover illustrated in Fig. 2 in the engagement position; and

Fig. 5 is a sectional side view of the belt retraction mechanism illustrated in Fig. 4 in the open position.

In the following description, like reference characters designate like or corresponding parts throughout the several views of the drawings.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to Figs. 2 and 3, there is illustrated a belt retraction mechanism 200 according to a preferred embodiment of the present invention. Whilst this embodiment is directly applicable to the harness of a child restraint or safety seat, the invention could equally be applied to other situations where a lockable belt

retraction mechanism is required such as a safety harness for a seat or where belts are employed to secure goods whilst being stowed.

Belt retraction mechanism 200 includes spool 210 upon which belt 300 is wound upon. Spool 210 is spring loaded by clockwork spring 212 which applies a rotating force in an anticlockwise direction as depicted in Fig. 3 thereby retracting belt 300 into inlet 270 when the spool 210 is released. Equally other spring arrangements which bias the spool 210 to retract belt 300, such as a torsion spring or even resilient band arrangements are contemplated to be within the scope of the invention. To further tighten the belt 300 a shaft (not shown) can be mounted to engage the hexagonal nut 213 thus allowing manual rotation of the spool to tighten the belt 300.

Belt retraction mechanism 200 further includes actuator 240 mounted within housing 260 by protrusions 242 which slide in slots 262 located on each side of housing 260. Attached to actuator 240 is handle 250 which operates to move actuator 240 along slots 262.

Referring now to Fig. 4, actuator 240 also includes pawl 241 which in one position engages with the teeth of ratchet 211 which are located on one side of spool 210 and oriented to block retraction of the belt 300 onto spool 210. Attached to actuator 240 at slot 242 is coil spring 280 whose other end is attached to housing cover 290 at mounting point 291. Coil spring 280 functions to bias pawl 241 into engagement with ratchet teeth 211. Abutting actuator 240 is pivotable cam member 220 which consists of an arm portion 222 and cam engagement surface 221 which includes a plurality of teeth or ridges to improve gripping. Cam member 220 is pivotable about an axis defined by bolt 224 which attaches member 220 to housing 260.

Rotation of the cam member 220 in a clockwise direction as seen in Fig. 4 forces the cam engagement surface 221 against the belt 300. Withdrawal force applied to the belt 300 will cause the cam engagement surface 221 to grip the belt 300 and to urge it further in a clockwise direction thereby causing the belt 300 to be compressed

between the cam engagement surface 221 and bottom surface 271. This will prevent withdrawal of the belt 300.

A coil spring 230 is attached to an upper lip 223 of arm portion 222 and is attached at its opposite end to a slot 261 in housing 260. Coil spring 230 acts to bias the cam member 220 against actuator 240 when it is acting to release the cam member 220 and to further hold the cam engagement surface 221 against the belt 300 when there is clearance between the actuator 240 and cam member 220 to ensure that clamping of the belt occurs as soon as any withdrawal force is applied. Clearly, as would be apparent to those skilled in the art, other biasing means may be used in substitution for coil spring 230.

Referring now to Figs. 4 and 5, in operation, handle 250 is pushed towards housing 260 causing actuator 240 to slide along slots 262 against the biasing action of both coil spring 230, 280 thereby releasing pawl 241 from ratchet 211 and furthermore pivoting cam member 220 so that the cam engagement surface 221 is moved away from the belt 300 thereby releasing the belt 300. As pawl 241 is no longer preventing rotation of spool 210 and as belt 300 is free to move between cam engagement surface 221 and bottom surface 271, belt 300 will be retracted due to action of clockwork spring 212. The belt 300 can also be withdrawn thereby tensioning clockwork spring 212. On release of handle 250, cam member 220 under the action of coil spring 230 and without any opposing force from actuator 240 will return to an engagement position where engagement surface 221 will grip belt 300 to prevent removal. Furthermore, actuator 240 including pawl 241 will be drawn towards spool 210 along slots 262 to attempt to engage with ratchet teeth 211. As cam member 220 moves to the engagement position a retraction force on the belt 300 will cause the cam member 220 to clamp the belt 300 virtually instantaneously. However, if no retraction force is applied, the clockwork spring 212 in spool 210 will have sufficient force to rotate in an anti-clockwise direction (as seen in Fig. 4) until pawl 241 engages with the next ratchet tooth 211. Belt 300 pulled in this direction with respect to the cam member 220 will act to release the cam member 220 thereby allowing further retraction of the belt 300 until rotation of the spool is arrested by the ratchet 211, or the harness being

tight on the occupant of the safety seat. Pivoting cam member 220 takes the full load caused by any forced removal of belt 300 from belt retraction mechanism 200 once actuator 240 has been released.

In another embodiment, additional biasing means may be included to apply a greater force to the cam member 220 to urge it into more positive engagement with the belt 300 so that clamping of the belt occurs quickly without further movement of the cam member 220 being required from retraction force on belt 300.

As would be apparent to those skilled in the art, belt retraction mechanism 200 provides substantial advantages over the prior art. As the locking function is performed by the cam member 220 the disadvantages of prior art pawl and ratchet mechanisms are substantially addressed.

The invention has the advantage of holding the belt in its withdrawn position. For example, if the actuator 240 is operated and belt 300 withdrawn to extend the harness of the safety seat, then the harness and belt 300 will stay in that extended position when the actuator 240 is released. This is due to the pawl 241 engaging a ratchet tooth 211 which prevents rotation of the spool 210 in the direction of retraction. The belt 300 and the harness will retract as soon as the actuator 240 is again operated.

In an alternative embodiment, the pawl 241 and ratchet 211 may be deleted from the actuator 240 and spool 210. This will result in a positive retracting force always being applied to the belt 300 and will allow further tightening force to be applied manually to the spool 210. For example, a shaft mounted to, or engagable with, the spool 210 having an external handle could be used to further retract the belt 300 to maximise tension in the safety seat harness. The belt 300 would move freely past the cam member 220 when moving in this direction.

Although a preferred embodiment of the apparatus of the present invention has been described in the foregoing detailed description, it will be understood that the invention is not limited to the embodiment disclosed, but is capable of numerous

rearrangements, modifications and substitutions without departing from the scope of the invention as set forth and defined by the following claims.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS

1. A belt retraction mechanism including:

a biased spool having said belt wound thereon, said spool biased to retract said belt;

a biased cam member having an engagement surface, said cam member resiliently moveable from an engagement position wherein said engagement surface engages said belt thereby preventing movement of said belt to an open position; and

an actuator,

wherein said actuator is manually operable to an open setting to cause said cam member to move from said engagement position to said open position.

2. A belt retraction mechanism as claimed in claim 1, wherein on a release of said actuator from said open setting, said cam member moves from said open position to said engagement position.

3. A belt retraction mechanism as claimed in claim 1 or 2, wherein said cam member is pivotable and includes a cam arm abutting said actuator and located at an opposite end to said engagement surface, wherein on movement of said actuator to said open setting said cam member is caused to rotate from an engagement position to an open position.

4. A belt retraction mechanism as claimed in claim 3, wherein said actuator is retained in substantially linear slots to guide movement of said actuator when acting against said cam arm.

5. A belt retraction mechanism as claimed in any one of the preceding claims, wherein said actuator further includes a handle, said handle arranged to be operable from a location substantially opposite to an inlet of said belt retraction mechanism into which said belt is retracted.

6. A belt retraction mechanism as claimed in claim 5, wherein said engagement surface engages said belt by gripping said belt between said engagement surface and a surface of said inlet.

7. A belt retraction mechanism including:

a biased spool having said belt wound thereon, said spool biased to retract said belt;

a pawl and ratchet mechanism for preventing rotation of said spool in a direction of retraction;

a biased cam member having an engagement surface, said cam member resiliently moveable from an engagement position wherein said engagement surface engages said belt thereby preventing movement of said belt to an open position; and

an actuator;

wherein said actuator is manually operable to an open setting to release said pawl and ratchet mechanism and furthermore cause said cam member to move from said engagement position to said open position, thereby allowing said belt to be moveable.

8. A belt retraction mechanism as claimed in claim 7, wherein on a release of said actuator from said open setting said pawl and ratchet mechanism reengages thereby preventing rotation of said spool.

9. A belt retraction mechanism as claimed in claim 8, wherein on said release of said actuator from said open setting said cam member moves from said open position to said engagement position.

10. A belt retraction mechanism wherein a pawl of said pawl and ratchet

mechanism is integral to said actuator.

Dated this 18th day of November, 2003.

Britax Childcare Pty Ltd
By its Patent Attorneys
MADDERNS

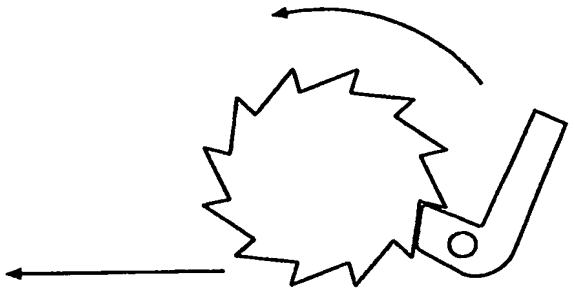

Fig 1

Prior Art

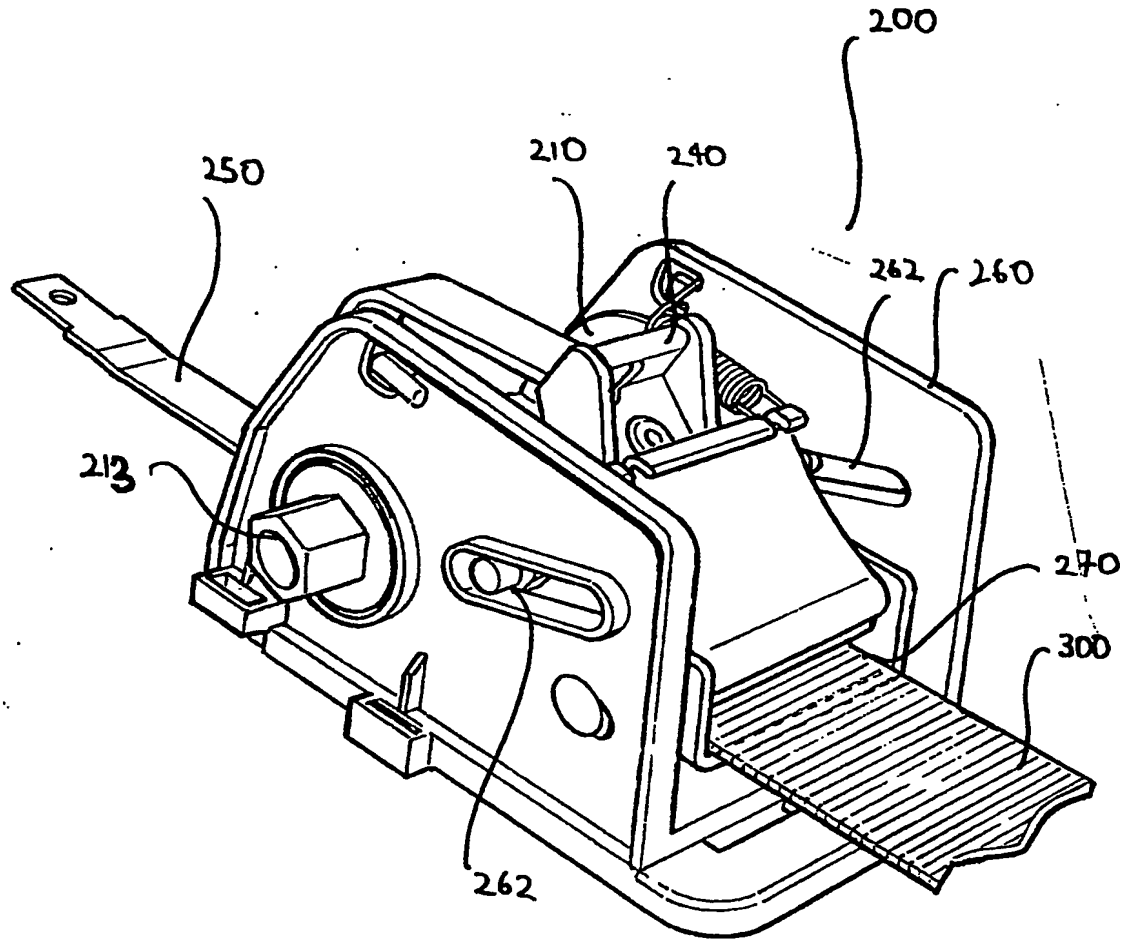

Fig 2

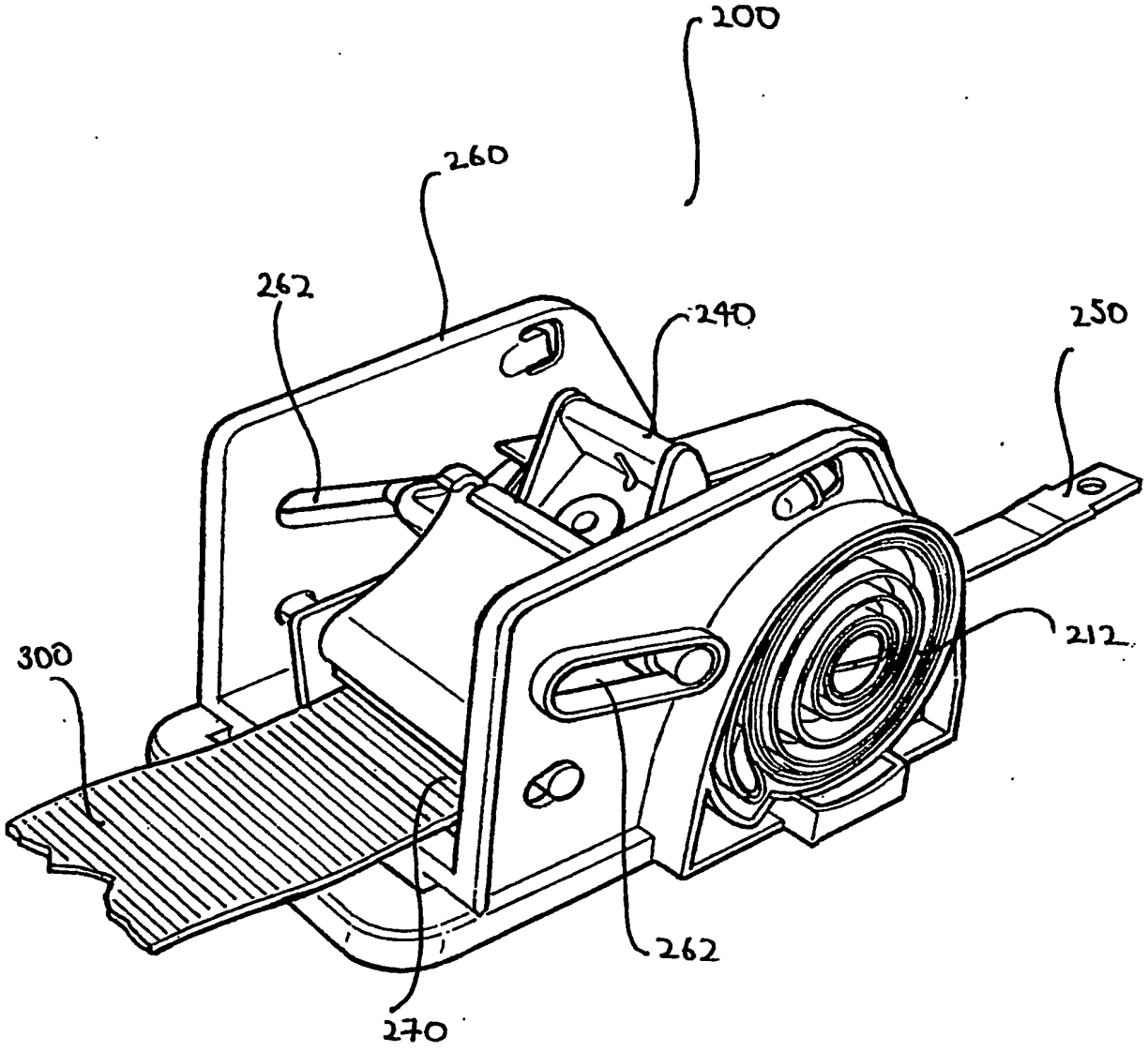

Fig 3

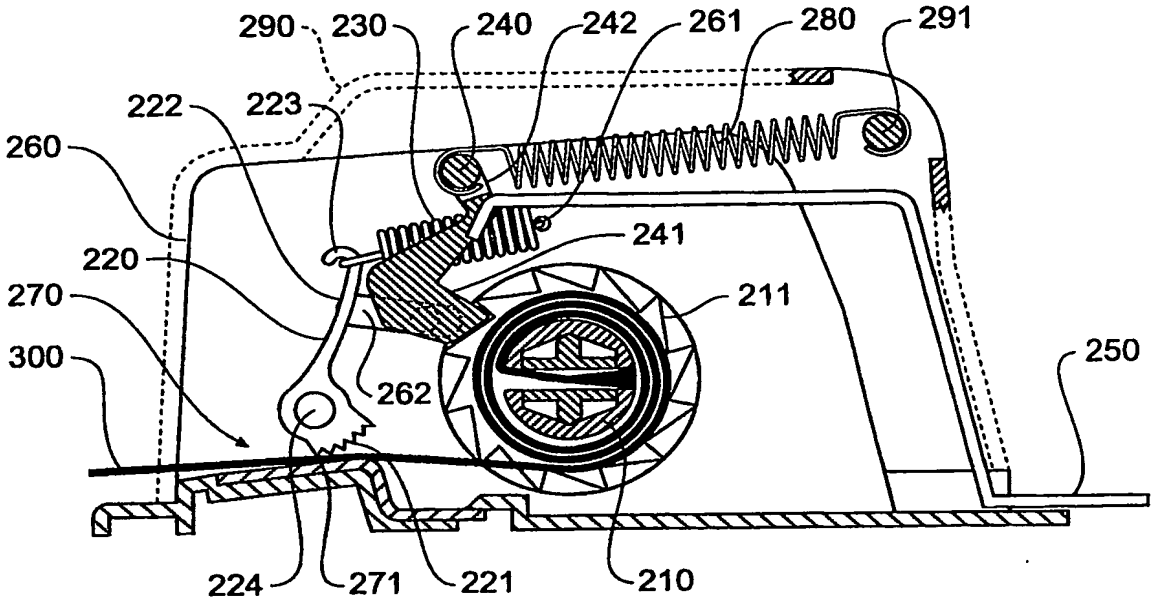
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Fig 4

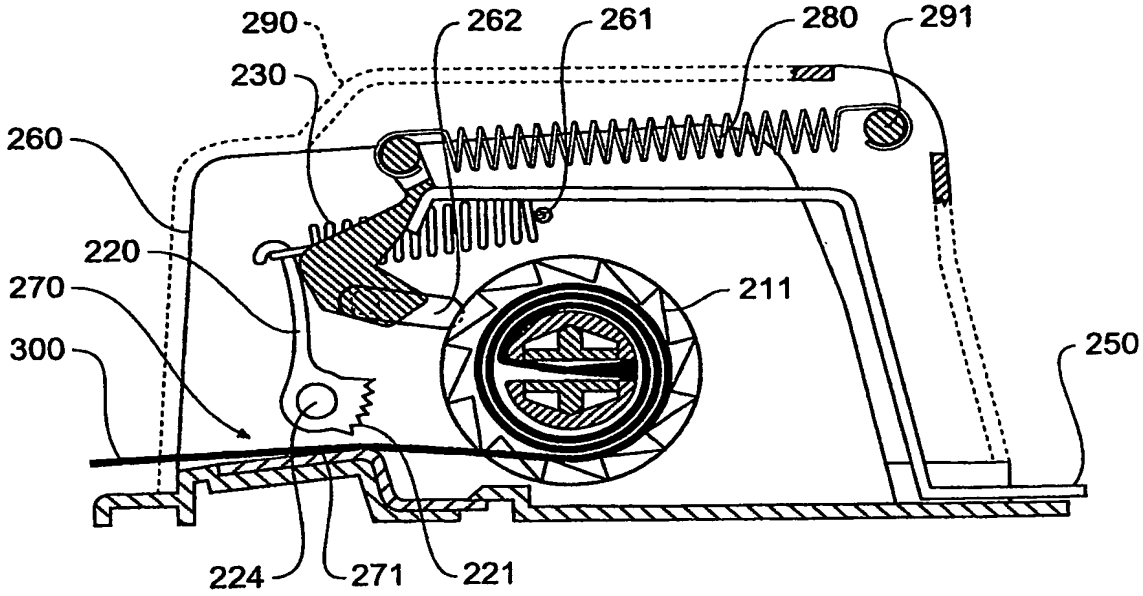
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Fig 5

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